IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Anthony John Dean et al. : Group Art Unit: 3746

Application No. 10/723,319 : Examiner: TJ Kim

Filed: November 25, 2003 :

For: PULSE DETONATION POWER SYSTEM AND PLANT WITH FUEL PRECONDITIONING

AFFIDAVIT UNDER 37 CFR 1.131

Assistant Commissioner for Patents
Alexandria, VA 22313-1450

S I R:

We, Anthony John Dean and Ivett Alejandra Leyva, being duly sworn, depose and state:

1. We are the coinventors of all of the claims of the patent application identified above and coinventors of the subject matter described and claimed therein.

2. Prior to July 20, 2003, we had conceived our invention as described and claimed in the subject patent application in the United States, as evidenced by the following:

a. Exhibit A is a Patent Disclosure Letter dated October 28, 2002 for the subject matter of the present patent application.

3. We were diligent in constructively reducing our invention to practice by filing the subject patent application in the United States on November 23, 2003, as evidenced by the following:

a. Exhibit B is a print-out of a task item for our patent attorney, Penny A. Clarke, that provides a timeline for Ms. Clarke's preparation of the subject patent application.

b. As indicated in Exhibit B, we discussed our invention with Ms. Clarke on January 17, 2003.

c. As indicated in Exhibit B, Ms. Clarke then proceeded to draft a patent application and provided an application to Anthony John Dean for review February 24, 2003.

d. As indicated in Exhibit B, Anthony John Dean and Ms. Clarke met to discuss the application August 14, 2003.

e. As indicated in Exhibit B, Ms. Clarke revised the application per Anthony John Dean's feedback and sent a revised draft patent application to Anthony John Dean for review on August 22, 2003.

f. As indicated in Exhibit B, Ms. Clarke discussed the patent application with Anthony John Dean and finalized the draft application Sept 16, 2003.

g. As indicated in Exhibit B, Ms. Clarke then requested formal drawings and formal papers September 16, 2003.

h. As indicated in Exhibit B, Ms. Clarke sent us the final draft patent application for our review and approval September 18, 2003.

i. As indicated on the Assignment and Declaration for the subject patent application, Anthony John Dean signed the Assignment and Declaration on September 18, 2003, and Ivett Alejandra Leyva signed the Assignment and Declaration on September 22, 2003.

j. The subject patent application was filed in the USPTO November 25, 2003 with formal drawings.

Anthony John Dean

Ivett Alejandra Leyva

Ivett Alejandra Leyva

Sworn to and subscribed before me
this 31st date of October 2005.

Jennie Lee Yourgas, **NOTARY PUBLIC**

JENNIE LEE YOURGAS
COMM. # 1376969
NOTARY PUBLIC-CALIFORNIA
LOS ANGELES COUNTY
COMM. EXP. SEPT. 27, 2006

Anthony John Dean 11/10/05

Sworn to and subscribed before me
this 10th date of November 2005.

Rita M. Lynch, NOTARY PUBLIC

RITA M. LYNCH
Notary Public, State of New York
Qual. in Rensselaer Co. No. 01LY6079764
Commission Expires 8/29/06

EXHIBIT A p 1 of 7

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GE Confidential & Proprietary Information.
This invention is being prepared for submission to the GE Patent And Legal Operation. Attorney work product may be contained herein.

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GE Patent Disclosure Letter System

DOCKET NUMBER

31193

DOCKET DATE

Monday, October 28, 2002

TITLE OF INVENTION

Stationary Power Plant based on Pulse Detonation Combustors

GE TECHNOLOGY AREA(S)

- Corporate R&D Advanced Technology Programs

Keywords:

  - Advanced Propulsion (PDE)
- GE Aircraft Engines (AEXX)
- GE Power Systems (PGXX)

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PROJECT NAME

AT on pulse detonation engines

PROJECT NUMBER

21423510101

PROJECT LEADER

Dean, Anthony, J

BUSINESS OR ORG. CONTACT INFORMATION

NAME Harvey Maclin

PHONE NUMBER

Was this invention first conceived or reduced to practice in the performance of work under a contract between GE and another non-government third party? NO

Date Invention Conceived : June 2000

Circumstances Invention Conceived i.e., described in patent notebook (include page #), technical report, letter, discussed in meeting minutes, etc.
Brainstormimg about possible applications for PDE's.

Was this invention first conceived or reduced to practice in the performance of work under a US Government contract?
NO

ABSTRACT OF THE INVENTION
Please write a brief explanation of the invention (Limit to 350 words)

This invention pertains to a hybrid engine where the traditional combined cycle power plant (Brayton cycle plus Rankine Cycle) is modified to include a pulsed detonation

Exhibit A p3 of 7

combustor within the gas turbine. This will improve the efficiency of the engine because pressure rise within the PDC reduces the amount of nergy required by the compression stage.

BACKGROUND OF THE INVENTION

Please describe the problem or requirement addressed by your invention.

The problem that we are trying to solve is to increase efficiency of power plants (both simple cycle and combined cycle). In addition, a pulsed detonation combustor reduces the number of parts and size and complexity of the rotating machinery.

How has this problem or requirement been addressed before?

Now, to achieve high cycle efficiency, the Pressure ratio and the working temperature have to be as high as materials and cooling technology permits. This results in complicated high pressure compressors and turbines. The combustion process results in a 4-7% pressure loss.

Is this disclosure letter related to any GE disclosure letters, patent applications or issued patents?

NO

Have you completed a prior art search? NO

Please list any relevant literature or patents of which you are aware.

DETAILED DESCRIPTION OF THE INVENTION

How does your invention work?

The combustion system is replaced by a pulsed detonation combustor (PDC). The PDC consists of a volume where a detonation is iniated in the fuel air-mixture. The volume can be a tube, or an arrangement such as a pre-conditioner of the fuel and then a detonation chamber. The products of the

detonation device are directed to the turbine. In an aero-derivative engine the PDC may replace the entire high pressure core. In a heavy-duty gas turbine, the PDC would require either a smaller compressor, or a turbine sized for higher pressure. There are several embodiments: Embodiment 1: A pulsed detonation combustor (PDC)applied to a simple cycle (Brayton cycle) power plant. Embodiment 2: A pulsed detonation combustor applied to a combined cycle powerplant (Brayton plus Rankine cycle) Embodiment 3: O2 addition for improved detonability (O2 via air separation plant, or via O2-membrane for example) Embodiment: Fuel reforming using waste heat and available steam from combined cycle power plant.

Describe the important features of your invention and explain how to use the invention to solve the problems described above.
The key feature of this invention is pressure rise combustion using repeating detonations (in contrast to constant pressure combustion). Don't need the high pressure compressor to raise pressure. Does it with detonations or fast flames. Simplicity - replace high pressure spool with pulse detonation engine Less parts to the system. More cycle efficiency.

What advantages are provided by your invention?
Achieve higher cycle gain by using pressure rise combustion. Reduce number of parts of the system. Since this is a stationary system, one can use additives to make heavy-hydrocarbons detonate. The additives can be H2 or O2 and can be added to the main mixture to a predetonation mixture. In addition, steam can be used to reform the fuel prior to entering the detonation chamber. This results in higher cycle efficiency and a more detonable fuel.

Has your invention been reduced to practice? NO

Briefly describe any efforts to make a prototype of your invention or to test your invention. Additionally, summarize the results of any related experiments and

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testing and highlight any results of particular significance.
A turbine-interaction rig is planned in '03 to test the viability of having flow from a pulsed detonation combustor enter a turbine section.

BRIEF DESCRIPTION OF THE DRAWINGS
Please describe the significance of any pictures, drawings, graphs, diagrams, structures or figures and the type of picture along with the specific view or application to the invention.
Schematics of this invention are enclosed in the file "Pulsed Detonation Combustor.pdf".

CLAIMED INVENTION
Please identify novel aspects that should be protected within this disclosure letter.
Cycle based on pressure-rise combustion vs. Brayton cycle alone or in combination with Rankine cycle. Possibility of using additives such as H2 and O2 which are proven to be effective detonability enhances since there is no weigth restriction. Also possibility of using steam for fuel reforming since it is readilty available in combined cycle power plants. Higher propulsive efficiency Less moving parts - less weight.

ATTACHED FILES
Pulsed Detonation Combustor.pdf

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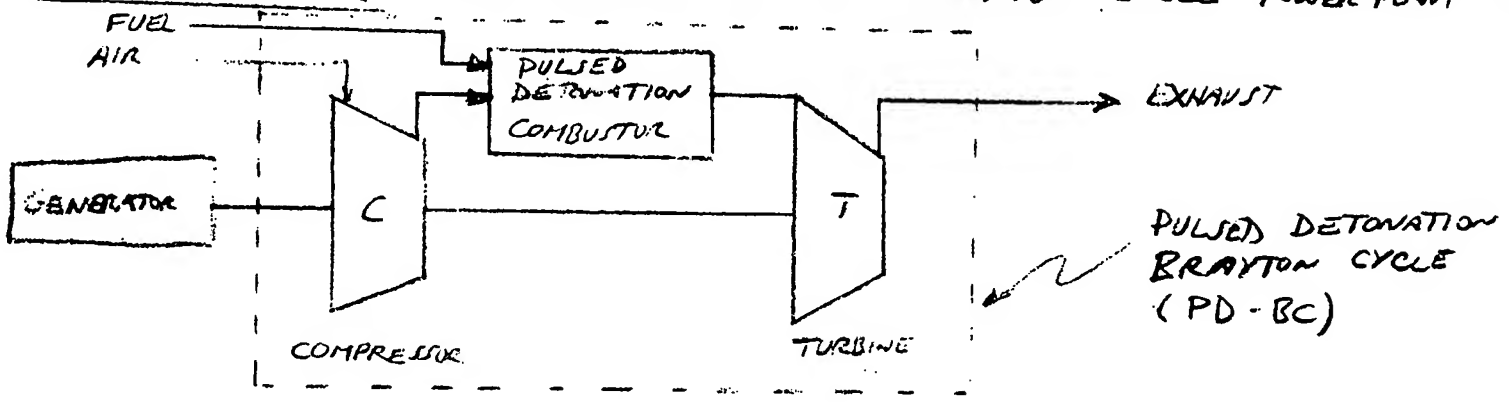
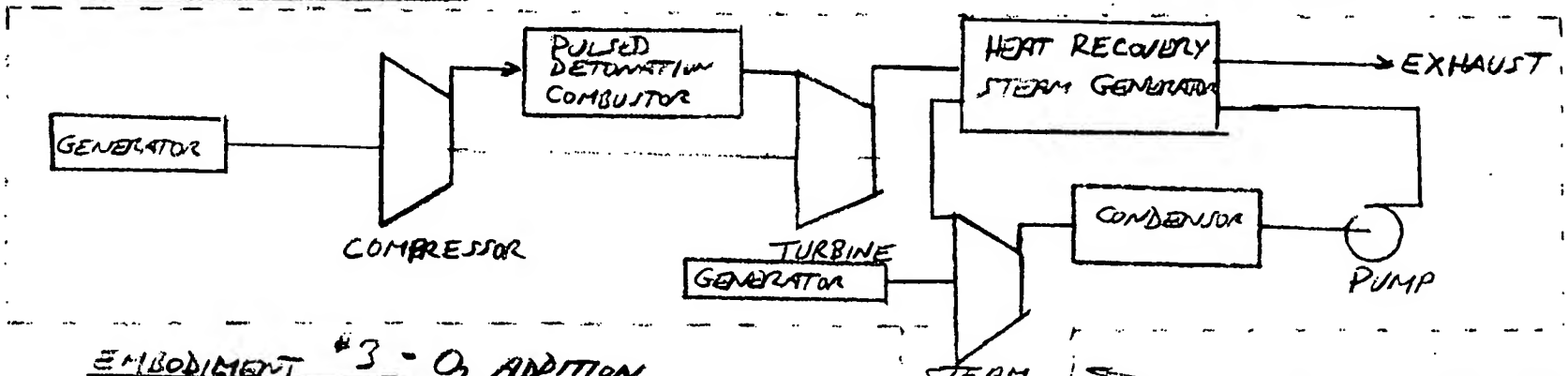
STATIONARY ENGINE POWERPLANT BASED ON PULSED DETONATION COMBUSTION

TONY D

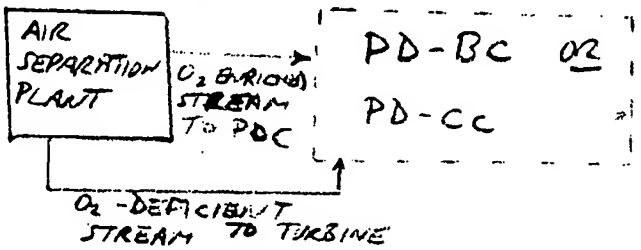
EMBODIMENT #1 - PDC MODIFICATION TO BRAYTON CYCLE POWER PLANT OCT. 22,



EMBODIMENT #2 - PDC MODIFICATION TO COMBINED CYCLE POWER PLANT



EMBODIMENT #3 - O_2 ADDITION FOR IMPROVED DETONABILITY

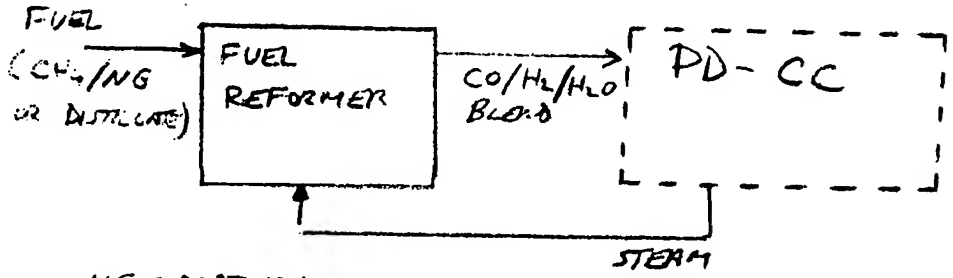


BEST AVAILABLE COPY

STATIONARY ENGINE POWERPLANT - BASED ON PULSED DETONATION COMBUSTOR

EMBODIMENT #4 - FUEL REFORMER FOR IMPROVED DETONABILITY

TONY DER
OCT. 22, ;



NG = NATURAL GAS

EMBODIMENT OF PULSED DETONATION COMBUSTOR - COMMON FEATURES

A. PDC WITH INLET, VALVES, DETONATION CHAMBER, OUTLET PLENUM

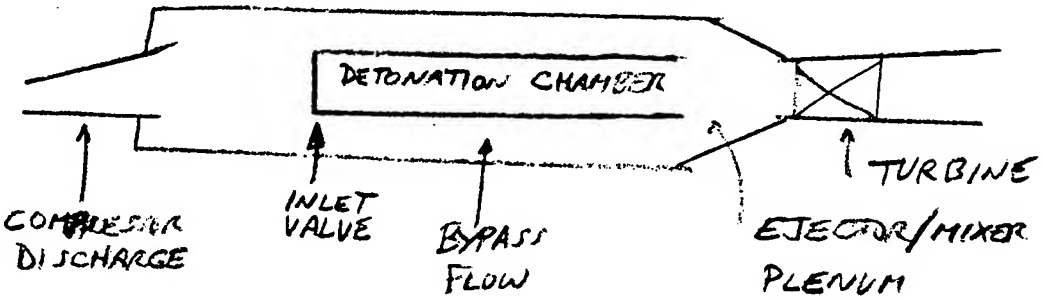


EXHIBIT B

Clarke, Penny (Research)

Subject:	130759 First Office Action
Due Date:	Friday, November 11, 2005
Status:	Not Started
Percent Complete:	0%
Total Work:	0 hours
Actual Work:	0 hours
Owner:	Clarke, Penny (Research)
Categories:	First Office Action

1) met w/ Ivett & Tony 1-17-03 & began drafting claims;
2) drafted application 2-20, 2-21 & 2-24;
3) application to Tony for review 2-24--req'd feedback by 3-10;
4) met w/ Tony Thur Aug. 14th to discuss application;
5) revised application per Tony 8-21/22 & sent to Tony 8-22 5PM for final review.
6) discussed w/ Tony 9-16. Finalized Sept 16th. Decl & assignment & formal drawings req'd Sept. 16th.
7) Sent to Ivett & Tony for final approval Sept. 18th AM.
8) US, FF, IDS, Checklist, PAGE updates to RL 11-21-03 for filing.
9) Link to complete drawings by Mon. 11-24-03. filed 11-25-03

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emailed Tony & Rita 5-4-04. submitted 5-18-04.

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prepared election of species and gave to Rita to submit July 20, 2005. submitted 7-21-05.